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ABSTRACT

A review of the literature indicates that, in spite of differences in methodology, faculty surveys permit an explanation of academic psychologist's interest in instructional computing, the current extent of instructional computer use, and the differences between interest and use. All of the studies reviewed indicated a substantial interest in educational computing. For psychology faculty, the primary interest is in using computers for statistics and laboratory methods courses. As a group, psychology faculty have strong impressions about how computers should be used in courses, but due to variations in survey methodology, trends cannot be discerned. Use of instructional computing in college level psychology teaching is modest but increasing. Use in statistics courses and data analysis is most common, with some additional use for data collection, demonstrations, and simulations. The difference between use and interest or perceived need is substantial and it has been hypothesized that this is due to faculty problems, adequacy of hardware, support staff, and software. Many of the barriers to implementing computer-based education are disappearing, and the time is ripening for bringing computers into courses as instructional aids. This report includes a 21-item reference list, 4 tables, and a list of the journals searched to identify computer software. (LMM)

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Interests in and Barriers to Computer Based Instruction of Psychology in Higher Education

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Interests in and Barriers to Computer Based Instruction

of Psychology in Higher Education

I am working with four other psychologists to produce computer instructional packages for use by psychologists in higher education. We are producing a package for each of the following topics: introduction to psychology, methods, sensation/perception, learning, and memory/cognition. Two factors guided our choice of areas for which we are developing microcomputer tools for instructional computing: Our belief about the instructional computing interests of academic psychologists and our personal interests and expertise. The purpose of this paper is to examine the instructional computing interests of psychology faculty and compare those interests to the goals we have chosen.

The primary sources of information on instructional computing are surveys of faculty interests. However, there are drawbacks to using only surveys as behavioral predictors. Thus, whenever possible information from other sources is used to support the conclusions of the faculty surveys.

Surveys on faculty interest

Over the past decade, a number of surveys have been conducted to determine faculty perceptions of the use of computers in education (Aaronson, 1983; Butler & Kring, 1984; Castellan, 1982; Cohen, 1983; Johnson, 1982). Aaronson studied 12 ongoing CAI projects. While her findings could be quite useful to instructors developing or planning to develop CAI materials, they do not provide much information about general faculty interests in computer aided or computer based instruction. Cohen reports on two surveys done at Dartmouth, one in 1975 and one in 1981. Johnson summarizes results of several large surveys of instructors from a variety of disciplines; the surveys were done between 1972 and 1979. Castellan examined in detail some subsets of the

data described by Johnson, particularly the data for psychology faculty. Butler and Kring surveyed psychological faculty at 5 schools in 1983.

These surveys differed in the nature of the population surveyed, the year in which the survey was taken, and questions asked. In spite of the differences in population and questions, the surveys permit an examination of several issures: Is there much interest in instructional computing? How much are computers used in instruction at the present? What explains the differences between interest and use?

Is there interest in instructional computing in higher education?

All of the studies indicate substantial interest. Johnson (1982) reported that 68% of college faculty were interested in using computers in instruction. Others have found the interest to be much higher. Castellan (1982) found that 88% of psychology faculty believed statistics courses should use computers and 71% believed computers should be used in laboratory courses. Butler & Kring (1984) found that 86% believed computers should be used in student labs and 68% believed they should be used in class demonstrations.

Primarily psychology faculty indicate an interest in using computers in statistics courses and laboratory methods courses, but there is a growing interest in using computers in other courses. Castellan (1982) reported that faculty interest was substantial for instructional computing in statistics and laboratory methods courses and was moderate for a number of content area courses (see Table 1). Butler and Kring (1984) also found substantial interest for using computers in statistics courses and interest in using computers in experimental methods courses, but the interest was not quite as large as found by Castellan (see Table 2). However, for every content course reported in Castellan's study, Butler and Kring found even higher interest in using computers. This suggests that interest in using computers in courses

other than statistics and methods may be growing.

As a group, psychology faculty have some strong impressions about how computers should be used in courses, but due to differences in surveys, trends cannot be discerned. Unfortunately, every survey has asked different questions about type of use and it is extemely likely that experienced and inexperienced computer users interpret concepts and questions differently. (Although the fact that the questions differ so much from survey to survey tells us something about the speed at which changes are occurring in this area.) Castellan (1982) found that faculty believed simulations and data analysis materials should be developed. There was also some interest in tutorial dialogues, problem solving materials, online testing and programming exercises. Butler and Kring (1984) reported that faculty believe there is great potential for using computers in student laboratories and substantial potential for class demonstrations, student homework, and individual projects.

Surveys in the future should take into consideration the problems indicated above, differences in questions make trends difficult to examine and differences in repondent's experience may cloud interpretation of results. I think one of the best approaches would be to design future survey instruments so that they educate the respondent about possibilities while measuring interest.

How much are computers being used at present?

There is only modest use of instructional computing in the teaching of psychology at the college level, although the amount of use appears to be increasing. In 1975 at Dartmouth, 29% of faculty respondents (21% of population receiving questionaire) reported using computers. Darmouth may have been slightly ahead of the country as a whole in 1975. Castellan (1982)

because he reports number of departments, not number of faculty) used computers in instruction near the end of the 1970s. In 1981, the percentage had risen to 34% (25% of population) at Dartmouth. In the most recent study of psychology faculty (Butler & Kring, 1984), 51% reported using computers in teaching but the return rate was low, only 26% of the population that was sent surveys reported using computers in instruction. Analysis of respondents suggests there has been a substantial increase in use of computers in instruction, but when return rates are taken into account, it appears that the increase over the past ten years has been modest. The exact function of the increase is not yet clear. It is important to realize that the 26% reported recently is substantial given that the first computer instruction project began in 1961. Growth appears to have been faster between 1961 and 1971 than during the last 10 years.

The most common type of course to include instructional computing is statistics. In Castellan's (1982) report and Butler and Kring's (1984) study, computers were used more in statistics courses than any other courses (see Tables 1 and 2). Experimental methods is the next most common, althould in Butler and Kring's study, respondents reported using computers as much in Introduction to psychology classes as in experimental methods courses. This could be due to greater number of introduction classes that are taught. Butler and Kring's survey also shows that use of computers in graduate courses is less than use in undergraduate courses.

The overwhelming use of computers in instruction is for data anlysis (see Johnson, 1982; Castellan, 1982), but computers are also used for data collection, demonstrations, and simulations. In a recent paper, Castellan (1983) suggested that there are 5 general ways to use a computer in instruction: drill and practice (useful for basic skills), data generation

(for studying data analysis), experiments (for understanding concepts), gaming (for learning higher order skills), and as a tool (for textprocessing, problem solving, etc.). Castellan's (1982) study suggests that drill and practice and games are not being used and only some of the tool capabilities are being utilized, word processing and computer testing are relatively rare uses.

The difference between use and interest or perceived need is substantial. Table 1 (Tables 10 and 11 from Castellan, 1982) shows the perceived needs and reported use of psychology faculty in a number of areas within psychology. As you can see in the Table, use lags far behind perceived need. Table 2 (Table 2 from Butler and Kring, 1984) shows similar results from a study done 4 years after the study reported by Castellan. (Note that Stevens, 1982, in her survey of teachers in grades K-12 also found that use lagged far behind perceived need.) If there are any major differences between Castellan's report and Butler and Kring's report, it is an increase in the perceived potential or desirability of using computers in a number of content courses. However, there is no similar difference in present use.

Why are there such large differences between use and interest?

Each survey has attempted to get some answer to this question. Table 3 is a summary of hypotheses described in one or more of the surveys. Each of these hypotheses will be discussed separately.

1. Faculty Problems.

According to Johnson (1982) this may be an important problem at smaller schools, especially since smaller schools cannot at this time respond by hiring new faculty with the requisite skills. However, I suspect that this conclusion is a bit premature. Instructors are not expected to write their own textbooks or produce their own films, why should they be expected to produce all of their own computer-based instruction materials? In fact there

are problems with dependence on locally produced materials. Johnson points out that they do not permit building on the work of others and have other disadvantages. The advantages to using published materials are numerous: Some quality control can be encouraged by the market, it saves many faculty resources such as time, and it does not require "higher education" to wait until many faculty are trained before implimenting quality computer-based instructional materials. One of the largest barriers to published materials is incompatability of hardware among campuses (eg., see Johnson, 1982; Spivey, 1983).

2. Hardware.

Educators may not have adequate hardware today, but that is changing rapidly. The first commercial computer came on the market in 1950. Since that time, the cost has decreased at approximately 30% per year and the number of computers available has grown substantially. In 1975 microcomputers began to be marketed. From an instructional standpoint, these machines have some advantages over large and medium sized computers. They are inexpensive and are relatively easy to use. Educators have been obtaining microcomputers at rates that are almost incomprehensible. By 1980, there were about 31,000 micros in education, by 1981 there were about 52,000, by 1982 there were 96,000, and by 1983 there were about 250,000 (Melmed, 1984). Each year, microcomputers become less expensive, more portable, and more capable. Like many other observers (eg., Johnson, 1982), I believe that lack of useful hardware is a problem that is beginning to disappear. However, there are still substantial differences in hardware compatability.

New types of hardware are also to be found at many educational media centers at colleges and universities. Some believe that these new technologies, such as computer interfaced video disk and speech comprehension

interfaces with computers, will give even a stronger push to the use of computers in education (see Hirschbuhl, 1980). But these technologies are not widely available in numbers that make them useful for education. These newest technologies will probably not play a major role in the next few years.

3. Support Staff.

Support for computer instruction materials is growing. Dayton (1981) completed a comprehensive survey of experts in production of instructional media. Most of these experts (71%) had extensive experience in higher education. Some of the questions Dayton put to these experts concerned computer-based instruction. Table 4 summarizes some of their answers. There is no doubt tha. they expect growth of computer-based instruction. In addition to the responses summarized in Table 3, Dayton found; these experts believed there would be some funding problems for production, most have already made many changes in the training of staff (to include computer technology), and it was widely believed that large commercial distributors will become the dominant supplier of computer-based materials.

It seems likely then that most institutions of higher eductation will have access to some support staff for instructional materials, but the situation is not as clear for hardware support. Some campuses, such as Darmouth have been using a large computer for most CAI. But the growing trend for using microcomputers will negate the centralized approach Darmouth has taken. Campuses will undoubted be developing policies to handle this potential problem, but it is not yet clear what those policies will be across campuses.

4. Software.

In his summary in 1982, Johnson suggested that "effective instructional software is increasingly the major factor in using computers in teaching."

According to recent reports (see Russ-Eft & McLaughlin, 1983; Tinker, 1983), there are about 700 instructional software development organizations in the U.S.. Together they produce about 2100 programs. However, most of these programs are of very poor quality and concern simple drill and practice of elementary school material.

The number of software packages available for university level teaching is very modest. As I describe the availability of software you might find it useful to keep in mind that there are about 150 current introduction to psychology textbooks on the market and a substantial number of statistics and experimental textbooks.

I examined the last 9 years (1974-1983) of 25 journals concerning teaching in psychology and/or the use of technology in education (see Appendix 1) and found fewer than a dozen programs that were potentially useful for psychology instruction. Most of the programs I found concerned statistics. Generally they were written by the authors of the article. However, a number of articles mentioned an organization, CONDUIT, that was a source of useful programs. At present, CONDUIT has 7 microcomputer instruction packages for use in psychology (primarily for introductory lab courses and methodology) and two interdisciplinary statistics packages.

Eamon (1983) reviewed a variety of programs available for the Apple II microcomputer. He reports 7 statistics packages (not all are appropriate for instruction), 7 simulation/demonstration packages, 7 experiment/games packages, and 1 drill and practice package. Eamon's review covers several of the CONDUIT packages.

Recently, Cozby (1984) published a book called "Using computers in the behavioral sciences." The number of pages in the book dedicated to various topics is consistent with the general lack of software indicated above. The

introduction to computers is 28 pages, statistics (including some coverage of canned programs such as SPSS) covered 104 pages, learning to program and computer languages received 23 pages, and all other uses (which included CAI) were covered in 26 pages. No CAI programs were included in the book, but again CONDUITs name appeared.

During the Spring of 1984 at the meeting of the Midwestern Psychological Association, several software developers demonstrated or described packages for use in Psychology. Again, most of the programs concerned statistics, but some (such as McGraw-Hill's new programs) are aimed at content areas of Psychology. While the instructional value of some of programs demonstrated was dubious, there is clearly a trend for larger distributors to make instructional programs available. I think that it is clear to private business that not all instructors have time to create all the materials they want students to read (hence book publishers) and not all instructors have time to create computer software (hence a new market).

The Barriers are Disappearing

Many of barriers to implimenting computer-based education are disappearing. Education administrators around the country are supporting growth of computer-based instruction (eg., vanHouweling, 1983). Instructional media specialists are training personnel to use computers as instructional tools (Dayton, 1981). Major computer companies are lowering prices and finding other ways to encourage instructional computing (eg., the "Wheels for the Mind" Apple Foundation Grants; also see Lebow, 1984a, 1984b). Large national distributors, such as CONDUIT, are emerging as important sources of software. Faculty interest is high (Butler & Kring, 1984; Castellan, 1982).

We believe the time is ripening for bringing computers into content courses as instructional aids. In Table 2 you can see that respondents to the

most recent survey (Butler & Kring, 1984) indicate that the greatest potential is in statistics, methodology, tests/measures, sensation/perception, learning, memory/cognition, and physiology at the undergraduate level and methodology, tests/measures, sensation/perception, learning, memory/cognition, and language/speech for graduates. The modules we are developing (Intro to psychology, methodology, animal learning, memory & cognition, and sensation/perception) are a subset of those the survey indicates have greatest potential. However there are areas we are not working on that also would be useful (eg., physiology).

The Role of Computer-based instruction and its evaluation

It is unknown if the attitudes measured by the surveys are reliable indications of potential behavior of academicians. Instructors may be willing to try something (if the cost is not too great, in time or other resources), but may not keep with it if it does not satisfy professional interests such as efficient, effective teaching. A meta analysis on research comparing computer based instruction to conventional instruction (Kulik, Kulik, and Cohen; 1980) suggests that computer based instruction produces slightly better student achievement and slightly higher course ratings than conventional classes, but they do not provide any data on efficiency. In a recent review article, Kearsley, Hunter and Seidel (1983a, 1983b) state "there is ample evidence that computers can make instruciton more efficeint and effective." Importantly, Kulik et al. and Kearsley et al. did not include only high quality software. The advantages to excellent computer-based instruction may dwarf those found thus far.

We know more today about quality instructional programming than did the pioneers in instructional computing. Good principles of design (such as those encouraged by Gagne) have been described and importance of factors such as

input methods, CRT displays, error handling, and documentation have been studied (eg., see Castellan, 1983). But there is much we still don't know (eg., see Kearsley, Hunter and Seidel, 1983a, 1983b). Some of the techniques we plan to use, such as the electronic chalkboard and vertical integration, have not yet been critically evaluated. The importance of studying these efforts, producing better instructional materials, and publishing evaluations of new materials cannot be overemphasized. This paper is only the beginning of the evaluation of our project.

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Table 1: Present Use of Computers and

Faculty Perceptions of Computer Needs

Present Use		Perceived Need	
Course Type	%	Course Type	%
Statistics	24	Statistics	88
Experimental Methods	12	Laboratory Methods	71
Experimental Design	4	Cognitive Psychology	43
Multivariate Analysis	2	Sensory Psychology	25
Introductory Psychology	8	Physiological Psychology	23
Research	8	Social Psychology	20
Computer Applications	8	Animal Psychology	20
Social	3	Clinical Psychology	11
Cognitive	2	Other	17
Physiological	2		
Sensory	1		
Clinical	0		
Other (Independent Study, etc.)	24		

Table 2: Present and Potential Use of Computers in Undergraduate and Graduate Courses

Course	Undergraduate		Graduate	
	Present %	Potential %	Present %	Potential %
Statistics	19	75	5	61
Methodology	11	53	5	40
Intro to Psychology	12	40	2	19
Tests/Measures	4	61	4	44
Sensation/Perception	4	56	2	42
Learning	5	54	4	42
Memory/Cognition	5	56	4	44
Physiology	0	40	2	30
Language/Speech	5	37	2	35
Social	5	35	0	26
Personality	2	30	0	26
Abnormal/Therapy	2	30	5	33
Motivation/Emotion	0	33	0	30

Table 3: Hypotheses to explain difference between perceived need and present use of computers in instruction

1. Faculty problem: lack of time, training, and/or academic reward
2. Lack of Equipment
3. Lack of Support Staff
4. Lack of Quality Software

Table 4: Beliefs of Experts in Instructional media Production

(data from Dayton, 1981)

Statement	Not Likely 1 2 3 4 5 6 7 8 9 extremely Likely	mean
1. computer-based instruction will become a common medium of instruction	!--*--!	7.53
2. there will be an increase in interactive and branching instructional materials	!-*-!	7.59
3. instructional simulations and games will increase in popularity, primarily due to proliferation of computer technology	!*!	7.71
4. the mariage of random-access video and the microcomputer will make interactive video quite common	!-*-!	7.69
5. Due to energy conerns the tendency in the future will be to move information to people, not the people to the information	!*!	8.28

Appendix 1: Journals searched for computer-based software

Adult Education Quarterly

Alberta Journal of Educational Research

American Educational Research Journal

American Journal of Education

Association for Educational Data Systems (AEDS)

British Journal of Educational Technology

British Journal of Educational Psychology

Contemporary Educational Psychology

Contemporary Education

Educational Documentation and Information

Educational Administration Quarterly

Educational and Psychological Measurement

Higher Education

Improving College and University Teaching

Journal of Educational Psychology

Journal of Educational Research

Journal of Educational Measurement

Journal of Educational Technology Systems

Journal of Experimental Education

Journal of Research and Development in Education

Peabody Journal of Education

Performance and Instruction Journal

Review of Educational Research

Science Education

Teaching of Psychology

Technological Horizons in Education Journal (T.H.E. Journal)